Incorporating "The Illuminating Engineer."

Light and Lighting

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Principal Contents:

	PAGE
Editorial Notes	83
Notes and News	84
Lighting, Heating and Ventilation	85
Glass and the Lighting Industry	87
I.E.S. Annual Dinner	89
Floodlighting Problems....	90
N.I.C. Annual Report	91
The World's Most Brilliant Bridge	94
Lighting the Empire Exhibition (Glasgow).	95
Lighting Literature	98
Patents	100
Trade Notes	102
Where to Buy	105

Come, Let's Get Together!

LAST Month we said a word about the good work of the Four Special Sections of the Illuminating Engineering Society. (We gather there may be five next session!)

Now something about the four Local Centres with headquarters in Manchester, Leeds, Glasgow and Dublin —(there may be five before very long). Congratulations to the local committees and the local secretaries, whose good work everyone in the Society appreciates. (It *does* mean some sacrifice to undertake a voluntary task of this kind.)

The Centres are flourishing. The youngest of them —born in the North Midland Area only last year— shows great vigour, and has just held its first Annual Dinner. But the time is coming when the Centres should get together a little more. Secretaries should, at least once in the year, exchange ideas and pool experience. Members of local centres should have more chances of knowing one another and the people in London.

The Annual Dinner in London (the gathering on March 15th was as successful as ever) should furnish an opportunity. There is also the idea of an annual conference, with special papers, visits and social events. This suggestion is being considered. The time is ripe for it.

Another I.E.S. Dinner—in Leeds

We give elsewhere (see page 89) an account of the very successful annual dinner of the Illuminating Engineering Society held in London on March 15. New ground has been broken this year by the North Midland Local Centre of the society which, on the 21st, also held an annual dinner of its own, its first, but let us hope the first of a long series. There was an attendance of about sixty, which included the president (Dr. S. English) and the hon. secretary (Mr. J. S. Dow) from London, and the chairman and hon. secretary of the North-Western Local Centre (Mr. R. C. Hawkins and Mr. J. Sellars). Councillor Sellars, who presided, and who, in a genial humorous speech, undertook the toast of "The Guests," proved to be an ideal chairman. The toast of "The Illuminating Engineering Society," to which the president responded, was undertaken by Mr. R. N. Webb, president of the Manchester District Gas Association, whose reference to the efforts being made to interest local gas engineers in the work of the Centre was heartily applauded. A racy response to the toast of "The Guests" was provided by Alderman R. Winn, of the Watch Committee, who aptly illustrated his remarks by the exhibition of a miniature lamp on his watch chain and occasional conjuring with the shaded candles on the table, which were induced to emit flashes of orange light! Some excellent songs and humorous sketches followed the speeches. A welcome opportunity was afforded to those from London to meet members of the local committee and discuss the future of the Centre. As many of our readers are aware, the progress of this newly-formed Centre—the membership of which is already approaching the 100 mark—has been remarkably rapid, in a large measure owing to the hard work of its energetic honorary secretary, Mr. J. W. Howell.

A Reference to Leon Gaster

It is gratifying to note that in the two-volume "Handbuch der Lichttechnik" just published in Germany there is an enthusiastic tribute to the work done by the late Leon Gaster in the early days of illuminating engineering. In his account of the Illuminating Engineering Society of Great Britain (nearly two pages in length) Dr. Lux says "Gaster's exceptional international relations and his complete mastery of several languages soon made the society well known, and in the period before the war there was scarcely any internationally recognised lighting expert who had not contributed to the "Illuminating Engineer" some article in which he discussed before an English public some of the problems in his special field of work.

The Electrical Supply Industry

At their annual luncheon at the Savoy Hotel on March 18 the E.D.A. were fortunate in having as their chief guest the Rt. Hon. E. Leslie Burgin, Minister of Transport. His address sparkled with amusing interpolations ("Electricity is the most marvellous thing—there is nothing it cannot do—electricity makes me think"), but also solid facts and figures illustrating the growth of the electrical industry and the good work done by the British Electrical Development Association. He recalled that the latter was formed in 1919 and had now a membership of 444. In 1927 the capital expenditure in the electricity supply industry was about £240,000,000, its revenue about £40,000,000 and its consumers 2,000,000. Ten years later the capital expenditure had risen to £570,000,000, the income to £70,000,000, and the number of consumers to 8,500,000. In connection with the distribution side and the forthcoming legislation he reminded his hearers that unity was strength. Allusion was made to the work on behalf of the Association, of Mr. Cramb and Mr. Beauchamp, and to the presence of Miss Caroline Haslett. The toast was coupled with the name of the president, Alderman J. Chuter Ede, who presided.

I.E.S. Meetings

LONDON.

April 5th. Mr. L. J. COLLIER on **Telephotometry** (Photometry Section of the Illuminating Engineering Society) at the *Westminster Technical Institute;* **6.30 p.m.**

April 12th. Mr. J. W. RYDE on **Luminescent Materials and their Application to Light Sources** (General Meeting of the Illuminating Engineering Society), (*Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1*); **6.30 p.m.**

April 29th. Discussion on **Glassware in Relation to Decorative Lighting** to be opened by Mr. OLIVER P. BERNARD and Dr. W. M. HAMPTON (Decorative Lighting Section of the Illuminating Engineering Society), (*Lecture Theatre of Holophane, Ltd., Elverton Street, Vincent Square, London, S.W.1*); **6.30 p.m.**

May 10th. Annual General Meeting of the Illuminating Engineering Society. After the presentation of the Annual Report and Accounts and the transaction of formal business, an Address will be delivered Reviewing Progress in Illuminating Engineering abroad (*Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1*); **6.30 p.m.**

DUBLIN.

April 5th. General Meeting (I.F.S. Local Centre of the Illuminating Engineering Society), (*Engineers' Hall, 35, Dawson Street, Dublin*); **8 p.m.**

Illumination Levels and Comfort Conditions

The Lighting, Heating and Ventilation Problems

In what follows we give a summary of a paper read by Mr. F. C. Smith at the Joint Meeting of the Illuminating Engineering Society and the Institution of Heating and Ventilating Engineers, on March 1st, 1938.

In introducing his subject Mr. F. C. Smith pointed out how closely related are the problems involved in lighting, heating, and ventilation. To members of the Illuminating Engineering Society it is unnecessary to emphasise the importance of good lighting, but the requirements in regard to heating and ventilation are also important, and equipment provided designed to furnish the one may have a material influence on the other. In both cases the technique is concerned with the response of the subject. Heating and ventilating engineers and illuminating engineers are all concerned with radiation, though of different wavelength. The former are now using distribution diagrams not unlike those adopted in connection with lighting problems. Furthermore the production of light, even by the most modern methods, is a comparatively inefficient process. Heat, which is the major consideration of the heating engineer, is a by-product of the production of light. The aim of the paper was to bring the requirements of both amenities into focus so that the most desirable results from both standpoints might be achieved.

Factors influencing Health and Comfort.

Mr. Smith then proceeded to analyse the factors associated with artificial heating which influence health and comfort. Comfort is dependent upon (1) the rate of heat interchange between the human body and its environment, and (2) the manner in which heat is lost from the body. The factors which will influence this rate of heat interchange are:—

(1) The mean surface temperature of the clothed body, (2) Air temperature, (3) Air movement, (4) Temperature of walls and other objects in the environment, (5) Humidity, (6) Bodily exertion, the generated heat being dissipated mainly by evaporation, (7) Actual clothing worn.

A Scale of "Equivalent Warmth."

The author stated a formula connecting the "comfort rate" with surrounding temperature, pressure of water vapour present, and air velocity, and described in turn the chief instruments (hygrometers, anemometers, globe, and kata thermometers, etc.) used in computing the physical conditions prevailing in an environment. This led to an explanation of "equivalent temperature" and the proposed scale of equivalent warmth.

An important point emphasised by the author was the distinction between air change and air movement. Whilst the value of air movement was accepted, he said, it still remained true that the admission of clean, fresh air was essential to health. The author regarded as very questionable the idea that is being applied to some modern buildings, that chimney flues are not essential in living rooms, etc. Interesting figures were presented in regard to the fresh air supply required, in cubic feet per minute per person, in varied circumstances. The rate may be allowed to diminish as the air space per person is increased and in the table varied from 11 to 38. In general, for persons of average cleanliness, 1,000 to 1,200 cu. ft. per hour per person will give satisfactory results.

Illumination and Visual Acuity.

Having thus dealt with the heating and ventilating problems of to-day, Mr. Smith turned to illumination and seeing, which he discussed on similar fundamental lines. He remarked that the mere provision of a given number of lumens does not in itself ensure a a given "level" of illumination. (Since the name of the Society is not "the Foot-Candle Society" it is clear that no such suggestion is implied!) There are many factors on which vision depends (field brightness, contrast, size of object, time of presentation, glare, colour, etc.) At present it is not possible to propose a scale of equivalent vision analogous to the scale of equivalent warmth developed in connection with heating problems. The author presented the familiar curves showing that when a black object is viewed against a white background (80 per cent. reflection factor) visual acuity increases rapidly up to an illumination of 8 foot-candles, but thereafter rises only very slowly. On the other hand, if the background has a reflection factor of only 8 per cent. visual acuity is considerably facilitated up to 80 foot-candles, after which improvement again becomes small. Similarly Weston's researches have shown that when the size of an object viewed is small, the curves connecting illumination and performance do not flatten until a relatively high value (100 foot-candles) is reached—though the improvement after 20-30 foot-candles is not marked.

Where Magnifying Glasses are Helpful.

For object sizes of less than 10 minutes there is little improvement after 6 foot-candles has been

reached. On the other hand, in the case of very minute objects the use of magnifying glasses may be more effectual than higher values of illumination. This is confirmed by the fact that even with a field brightness of 100 millilamberts and with the greatest possible contrast it is impossible for the eye to resolve an object subtending an angle with the eye of less than about 0.6 minute. After pointing out the prejudicial effect of glare in increasing the degree of contrast to enable an object to be distinguished, and touching on the very debatable question of colour, Mr. Smith suggested that in the case of those very exacting tasks which do not require a very high illumination the requirements can best be met by means of local units.

The I.E.S. Recommended Values of Illumination.

Mr. Smith reproduced the I.E.S. Recommended Values of Illumination. Since the areas where exceptionally high illumination is desired in factories, etc., are usually relatively small, such cases can readily be dealt with by means of local lighting. If this is done the heat developed by the lighting system would not greatly exceed that associated with a general illumination of 6-10 foot-candles.

Although in the above recommendations 15-25 foot-candles are considered adequate for large departmental stores, even higher values have been suggested, e.g., as much as 50 foot-candles in America.

Heat Output at High Illuminations.

As an example of the effects of such high values on heating problems the author worked out the case of a typical store with an area of 10,000 sq. ft., and with floors 15 ft. high. With a utilisation factor of 40 per cent. it is shown that the resultant heat would be 16 per cent. of the total requirements with an illumination of 15 foot-candles, but as much as 54 per cent. with 50 foot-candles. With a utilisation factor of 20 per cent. these figures would be doubled, i.e., with 50 foot-candles the heat produced would actually exceed the total heat requirements so that the lighting would afford more than all the heating necessary for the room. If it be assumed, therefore, that the premises were adequately heated before the lighting was turned on, it is apparent that, for the higher levels of illumination and a low utilisation factor, comfort values would become intolerable. On the other hand, with moderate values of illumination, and assuming a heating system which is flexible and thermostatically controlled, the contribution of the lighting to the heating of the premises may be of decided value.

In passing, the author referred to certain special cases for which 25-30 foot-candles are considered necessary. Fine inspection work and watch-making and jewellery can, no doubt, be dealt with by local lighting. For drawing offices indirect lighting is sometimes advocated. With this form of lighting the utilisation factor is low and heat inputs of a higher order than those associated with direct lighting may be expected.

Classes involving a range of 5-15 foot-candles are important because they involve the great majority of tasks. In this connection two possible cases in factories are considered. In the one case, a single-floor factory with a north-light, the provision of 15 foot-candles would mean that 90 per cent. of the total heat requirements was furnished by the gas-lighting and 9 per cent. by electric lighting. In the second case, a three- or four-storey mill of similar floor area, the gas-lighting would furnish 117 per cent. and electric lighting 12 per cent. In both cases it was suggested that gas-lighting could make a useful contribution to a controlled lighting system, but in the second case more care needs to be exercised in relating the heating and lighting systems at the higher orders of illumination.

Churches and Public Halls.

In the case of classes involving the provision of 2-5 foot-candles, it is clear that the heat contribution from either system, whilst extremely useful in certain cases, will not assume proportions difficult to handle by any heating system worthy of consideration. In churches and public halls, used intermittently, and where financial considerations make it difficult to put the central heating system in operation early enough to secure comfort, a lighting system contributing substantial radiant heat is advantageous.

Conclusion.

The ranges of illumination prescribed in the I.E.S. Code are of considerable interest, since, as is to be expected, they interpret the important principle that equal increments in illumination do not mean equal increments in seeing facility. On the other hand, equal increments in illumination do correspond to equal increments in the contribution made to the heating by the lighting installation. The same increments in seeing facility will, therefore, represent a much smaller contribution to the heating requirement at the low levels of illumination than at the higher.

Where such high levels are insisted upon the illuminating engineer can assist by choosing units of high utilisation factor. Such a system, however, may place limitations upon the artistic effect it is desired to obtain.

Inferior maintenance at any illumination level is intolerable, but obviously it becomes of greater significance at the higher levels, since, in order to obtain a given minimum performance, it entails higher initial outputs with a correspondingly continuously greater heat input.

Glass and The Lighting Industry (1916-1937)

by

Bernard P. Dudding, M.B.E.,
F.Inst.P., A.R.C.Sc., F.S.G.T.

In what follows we give a summary of the lecture delivered by Mr. Bernard P. Dudding, at the Institution of Electrical Engineers, on January 12th, which formed one of a series arranged to celebrate the 21st anniversary of the Society of Glass Technology.

In the role of "The Man in the Street" we each take the developments in modern industry as a matter of course, accepting them as deserved privileges or regarding them as undesired nuisances according to our own peculiar taste. During the last twenty years a revolution has taken place in the production and utilisation of artificial light. The mutual reaction of the labours of scientists and technologists in the glass industry and the lighting industry is the theme of this lecture. What is the nature of the change which has materialised during these years? Primarily there has been a growing realisation that the amount of illumination normally available during the daylight hours is many times greater than that provided when artificial sources of illumination are used, and that the eye, although capable of adapting itself to low levels of illumination, operates most efficiently when they are high. To provide illuminations comparable to that of daylight conditions is so costly that the energies of all concerned with the production of artificial light have been directed towards reducing the cost by the development of illuminants of greater intrinsic efficiency and the provision of apparatus to distribute the light in the manner most suited to the varied conditions under which it is used.

It is interesting to recall that in 1916 the illumination considered suitable to office work was c. 1.0 foot-candle, whereas to-day the illumination available on the working plane in many offices is over 10 foot-candles. Again, the illumination on the newspaper read by a passenger in a first-class railway carriage in 1916 rarely reached 1.0 foot-candle, whereas the level of the illumination in the trains of the L.P.T.B. is c. 30 foot-candles.

All the credit of these changes cannot be given to the workers in the lighting and glass industries. A considerable part has been played by the glass industry in this development.

It is convenient to sub-divide the functions of glass in the lighting industry in the following way:—

(1) Glass envelopes, closed and open, for the primary illuminant.
(2) Glass articles for redistributing the light given by the illuminant—
    (a) by refraction:
    (b) by reflection.
(3) Glass shades and bowls used for aesthetic reasons

Glass as a Container or Envelope.

Glass has been used for many centuries as a container for oils, into which dipped a wick of some description—the burning of the oil being a source of illumination. These primitive vessels imposed no exacting requirements on the glass. However, in years prior to the period with which we are concerned, improvements in the design of lamps burning refined oil and the use of gas had called for an improvement in the nature of the surrounding envelopes, often in the form of a chimney, in order that they could withstand the sudden changes of temperature imposed in service. These so-called "heat-resisting" glasses were the pioneers of a movement which has gone very far since that time.

Improvement in the Electrical Properties of Glass.

The carbon and tungsten vacuum lamps which were the common small electrical units of illumination in 1916 called for no glasses having special qualities, the type of glass used being determined more by ease of fabrication. The introduction of the incandescent gas-filled tungsten filament lamp demonstrated the unsuitability of many of the glasses then in use for the construction of the internal portions of the lamp. This was due to the fact that the hot gas leaving the filament at temperatures approaching 3,000° C. considerably raised the temperature of the glass carrying the wires by which the current is led into the lamp and the glass carrying the supports.

The electrical properties of the glass received at tention, and adjustments were made in the composition, which, whilst not disturbing the ease of fabrication, greatly improved their behaviour in service, to the advantage of the lamp performance.

Since 1929 the development of the electric lamp has demanded glasses capable of withstanding considerably higher temperatures and possessing at the same time greatly improved electrical resistance properties. Modern glasses used in mercury vapour electric discharge lamps operate at temperatures exceeding 600° C., and their specific resistance at 600° C. is c.300,000 times greater than that of the common soda lime glasses. The high softening temperature can be illustrated by the following simple experiment. Four helices of electrical resistance wire are arranged to act as furnaces operating at closely the same temperature. A rod of glass is placed in each furnace horizontally. When it softens it bends and ultimately completes an electric circuit and lights a lamp. The glasses are—a lead glass of the type used for domestic ware, a normal lime soda glass as used for bottle making, a bora silicate glass suitable for laboratory use, and one of the new hard glasses. In fact, the electrical resistance of these new glasses at these high temperatures is higher than that of fused quartz, which has always been regarded as the high temperature insulator par excellence.

A simple experiment will demonstrate the enormous difference between the glasses. Rods of commercial lime soda glass and of the modern glass referred to above are each supplied with wires embedded in opposite ends. A 200-volt 15-watt lamp is placed in series with the rod of glass and 230 volts applied to the circuit. When the glasses are cold the current passing is practically zero. Now on heating them in the flame it is seen that the lamp in the circuit containing the normal soda glass lights up, the glass rod carrying a current of about 65 milliamps. The current flowing in the other circuit is still only a fraction of a millionth of an ampere, and the lamp remains unlighted.

Resistance to Action of Metallic Vapours.

It is generally known that special glasses have to be developed in order to resist the action of the corrosive liquids.

Recent developments in the field of electric lighting have demanded glasses which will resist the action of metallic vapours, such as sodium, cadmium, etc. Here the glass technologist has introduced glasses unknown in the past. Normal glasses blacken extremely rapidly when exposed to the action of sodium vapour. In this connection the lecturer arranged a dmonstration to contrast the amount of blackening of one of these special glasses after operating for 1,000 hours in a lamp with a normal lime soda glass subjected to the same action for ten minutes. When the two tubes were heated the soda glass blackened whilst the other remained clear. These new glasses are entirly free from silica.

Light Diffusing Properties.

The steady increase in efficiency of the tungsten filament lamp has tended to make the intrinsic bright-

ness of the source of light so high as to cause discomfort should the filament be in the line of view. This has led to two interesting developments in the production of glass envelopes having diffusing properties by which the filament is obscured. One method adopted is so to etch the inside surface of the glass bulb that its strength is not appreciably impaired and, at the same time, to secure a very small loss in the efficiency of the lamp. This internally etched bulb, known commercially as "pearl frosted," considerably reduces the brightness of the source and prevents the image of the filament being formed on the retina of the eye, but it involves a loss of luminous efficiency of less than 1 per cent.

Considerable improvement has taken place in the preparation of opal glass and, whereas opal shades or bulbs commonly used in 1916 involved severe losses in efficiency, modern bulbs and also shades can be obtained wherein the losses are less than 10 per cent. This progress is due entirely to investigations made during recent years by which the nature and physical condition of the material causing scattering of the light in the glass has been determined, associated with studies of the furnace conditions during manufacture, so as to secure optimum diffusion with minimum absorption. In addition, these investigations have made it possible to avoid classes of opal which, although optically satisfactory, are inherently very brittle.

Two globes were exhibited to illustrate the effect, and it was pointed out that the opal which caused the greatest loss of light was the one which caused so little diffusion that the filament could be seen through it.

Many modern opals are made as 2-, 3-, and 4-ply glass, the opal in the case of the 3-ply being placed between two layers of clear glass, like the meat in a sandwich. The technical problems associated with the production of this class of ware are particularly difficult. The glasses used have to be carefully matched in regard to their thermal properties, otherwise the goods are so fragile that they will not reach the warehouse, much less the customer. To ensure satisfactory ware it is now general to take sections of the ware and test the correctness of the glass by examination in polarised light.

Glass Refractors.

When a beam of light passes through parallel-sided slabs of glass it emerges parallel with its initial direction, but if the piece of glass is wedge shaped, then the beam of light is deflected. The designers of fittings wishing to place the light where it is needed whether in lighting a road or a work bench, have utilised this property of glass to attain that end. The effect of such a fitting is very well illustrated by the following experiment in which a refractor is placed over a light source. The precision called for in the production of these refractor fittings can be appreciated by realising that systematic errors in the direction of the light greater than 1 deg. should not be present. To attain this degree of accuracy the error in the glass prism must be less than two thousandths of an inch.

The introduction of the modern types of high-pressure gas lamps and the metal vapour electric discharge lamps has tended to raise the temperature of the glassware of the fittings. It has been necessary to modify the glasses used to increase their resistance against sudden temperature changes whilst still preserving those properties which enables the glass worker to produce the accuracy of form. Fittings are now available in which both surfaces are moulded, one set of mouldings serving to spread the light slightly and so reduce the brightness of the fitting without modifying its directive effect.

Reflectors.

Glass has been associated from the earliest times with silver deposits on its surface to form mirrors of high reflecting power and durability. Remembering that glass has the unique property of having no actual melting point, but of remaining plastic throughout a long range of temperature within which it can be moulded and worked, it is not surprising that the illuminating engineer has found great use for reflectors of all types and descriptions in his endeavour to improve the utilisation factor of the light from modern illuminants. Parabolic and ellipsoidal mirrors, mirrors parabolic in one direction and ellipsoidal in another have been used for producing beams of varying degrees of concentration. Blowing, pressing, and bending are each employed.

Interesting examples of the use of silver on glass mirrors are the units used for floodlighting landing grounds for aeroplanes. These provide a mixiumum candle power of 1½ millions, but consume only 9 kW of energy.

Many street-lighting fittings will be seen in use in which the distribution of the light is obtained by means of mirrors and not by means of refractors. Perhaps one of the most interesting illustrations of this use of glass is for those fittings frequently seen in shop windows. Here comparatively small units of 100 to 200 watts are used, and by means of suitably designed reflectors the light from lamps placed high up in the shop window can be concentrated in narrow or in wide beams on to the goods displayed below. In the earlier forms of this type of reflector images of the filament were produced and showed themselves as bright streaks of light across the goods. This can be avoided by placing the lamp in a frosted or opal bulb. This, however, reduces the amount of light which can be usefully used in the shop window from a given fitting, because of the large increase in the size of the effective light source.

By corrugating the glass on which the silver reflecting surface is deposited this defect can be remedied but still with a considerable loss of light unless special precautions are taken. Collaboration between the designer of the fitting and the glass maker has made it possible to develop forms of fittings in which these corrugations are so shaped that losses are reduced to a mimum. Fittings of this type are now regularly produced in which 70 per cent. of the light emitted by the lamp can be concentrated on to the working plane in the position desired.

Decorative Glass.

From the remotest times glass articles have been used for ornaments because of the enormous variety of colour and shape in which glass can be produced. It would be difficult to conceive of anything fundamentally new in the decoration of glass articles. The artists and craftsmen of many centuries have placed at our disposal innumerable designs and processes for the production of beautiful pieces of glassware. However, it is possible to claim that during the past twenty years there have been considerable technical developments in England by which glass articles having some claim to beauty can be purchased at prices within the reach of the average citizen, and in no field is this truer than in the lighting field. The output of this class of glassware has increased four to five times since 1916. Whilst the opal conical shade has not been completely eliminated from the office and the home, yet all will agree that it has been displaced to a very large degree by something more aesthetically desirable. It is impossible to place before you representative samples of all the types of lighting ware which are now available. These can be seen in many showrooms in all our large towns and cities.

Reference has already been made to the enormous improvement in the control of opal glass (some examples of which are on the table), and examples of coloured opal, a quite modern development, is represented by coloured opal bowls in which the minimum loss of light is associated with a pleasant colour and complete diffusion of the light. Fittings of this type are quite pleasant to the eye by day or by night.

The Illuminating Engineering Society's Annual Dinner

Photo by Rawood, Ltd.

The President (Dr. S. English) is seen standing in the background. On his right is Sir Alexander Maxwell, and on his left, Lord Ernest Hamilton.

The annual dinner of the Illuminating Engineering Society, held at the Trocadero Restaurant (London), on March 15, was again a most agreeable event.

Among the guests of the Society were Sir Alexander Maxwell (Permanent Under Secretary of State, Home Office), who proposed the main toast of the evening; Lord Ernest Hamilton; Sir David Munro (Secretary of the Industrial Health Research Board) and Lady Munro; Mr. H. C. Smith (President of the Institution of Gas Engineers) and Mrs. Smith; Mr. H. T. Young (Past President of the Institution of Electrical Engineers) and Mrs. Young; Councillor H. W. Sellers (Chairman of the I.E.S. North Midland Area Local Centre); Mr. C. I. Winstone (President of the Association of Public Lighting Engineers), and Mrs. Winstone. Past Presidents of the Society were again strongly represented.

The Illuminating Engineering Society.

The usual loyal toasts having been honoured, the toast of "The Illuminating Engineering Society" was proposed by Sir Alexander Maxwell, K.B.E., C.B. (Permanent Under Secretary of State, Home Office), who paid a tribute to the valuable influence of the Society in fostering the professional view—that good work should be the primary consideration rather than the securing of profit, and in promoting co-operative effort whereby its technical knowledge was placed freely at the disposal of mankind. Furthermore the Society afforded a common meeting ground where those associated with different sections of the industry could forget their rivalries and unite for common cause. Sir Alexander regarded factory lighting as a subject of great interest at the present moment, especially to his own department. He mentioned the recent inclusion of a clause in the Factory Acts requiring adequate and suitable lighting of factories and recalled the services of members of the Society who had served on the original Departmental Committee responsible for recommendations on factory lighting. It was interesting to note that the two original secretaries of that committee were present in the persons of two of the Society's Past Presidents, Dr. C. C. Paterson and Sir Duncan Wilson—the latter they all congratulated on his inclusion in the Honours List this year! Sir Duncan was now presiding over a committee which was considering the revision of the original recommendations, on which several members of the Society were again serving. He understood that members of the Society had also been serving on a committee concerned with the lighting of the streets—another matter of interest to his department in view of its relation to the prevention of accidents and to the work of the police. He wished the Society success in the valuable work which it was undertaking.

The President (Dr. S. English) in responding, thanked Sir Alexander very cordially for his sympathetic references to the work of the Society, and for his kindness in attending the dinner in spite of the many calls upon his time. After briefly referring to the work of the Departmental Committees concerned with street and factory lighting, Dr. English remarked on the rapid development of the work of the Society, and paid a tribute to the services of the honorary secretary. The Society had now four special sections and four local centres at work—with a prospect of more to come. He wished also to thank those members who had acted as chairmen or secretaries or on the various organising committees and thus made possible this very successful expansion of the Society's activities.

The Guests.

The toast of "The Guests" was proposed by Mr. Percy Good (Vice-President), who drew attention to the variety of bodies represented in the list of guests of the Society and made a special reference to the presence of Councillor Sellers, the chairman of the recently formed North Midland Centre. Finally, in referring to the ladies present, Mr. Good expressed the pleasure of members at the attendance once more of the two members of the staff (Miss Moreton and Miss Wright) whose long-continued services were much appreciated.

After Sir David Munro had briefly replied on behalf of the guests the hall was cleared for dancing, which continued until midnight.

Floodlighting Problems

by

D. G. Woolfenden, B.Sc.

Summary of a paper read before the North Midland Area Local Centre of the Illuminating Engineering Society on November 15th, 1937.

The Silver Jubilee and the Coronation have in turn shown that daylight in our towns and cities need no longer end at dusk. Shadowless street lighting and the floodlighting of public gardens, historic buildings, and amusement centres can give the after-dark hours an allure and gaiety of their own.

Why, however, should floodlighting be only in evidence during some great event? A hundred years ago everybody was in their own houses at dusk. Now, with well-policed streets and, needless to add, fairly well-lit streets, there may be actually as many people outside after dark as during the day. Why, therefore, not take advantage of the opportunity of revealing latent architectural distinction such as may possibly escape attention by day. It is now quite usual for churches, war memorials, industrial buildings, and cinemas to be floodlighted—indeed, the latter is chiefly familiar to most people under these conditions. It is true that the exterior of a cinema does not usually call for admiration in the same degree as, for instance, a Town Hall of noble design. This, however, is not because the cinema is a familiar object, but, most probably, either because the design is not impressive or because the floodlighting fails to show it to advantage.

Those who criticise the artistic effect of floodlighting should, however, bear in mind that its intention is not invariably to create a pleasing architectural effect—it is adopted much more frequently merely to attract attention. This is well illustrated by an incident within the writer's experience. An inquiry was received from a cinema manager in a small village who desired to illuminate his frontage. The building, however, proved to be a most unsuitable subject for floodlighting, as the frontage was confined to an area 14 ft. wide and 12 ft. high, directly on the building line of the road. On being informed of this the manager approached a second firm, who merely furnished the lighting units without comment. It was ultimately found that these units had been installed—but reversed, so as to throw their light into the road and attract attention from afar. This, truly, was an instance of " prosperity lighting " rather than floodlighting proper.

A cinema may appear unattractive at night for another reason, namely, that it is lighted so as to give an appearance similar to that by day. This would be an error of judgment, because we cannot hope to achieve the same result as that effected by the sun. Furthermore, whilst no hard and fast rule can be laid down, and admittedly each subject should be treated on its merits, it is surely wiser to realise that effects by artificial light are essentially *different* and lose effect if they merely perpetuate what is familiar by day.

One important feature of floodlighting, as compared with daylight, is the fact that light in general comes from below rather than from above, so that shadows tend to be cast upwards instead of downwards. Imagine a projection on a building which has a small ledge. In daylight a shadow is cast *below* the ledge, whilst at night the shadow is reversed. Looking up from underneath, a corner of the building can be seen which has never before been brought to notice. Underneath that ledge there may be some rich carving, and this is the feature the illuminating artist should observe. This carving cannot be seen during the day without going close to it, but at night it can be brought out and emphasised by a definite black line (the shadow of the ledge) above it.

Considering this further. A church doorway, a Gothic or Norman arch, usually has its carvings on the underside, which can always be seen to greater advantage when the sun is low on the horizon, i.e., when the light shines directly on to them. Now, by floodlighting, a similar effect can be achieved and maintained without any fear of the sun sinking below the horizon.

Hence the whole appearance of a building can be completely changed by altering the position of the light source.

A building may have a window, small and insignificant, which could be indicated by bearing additional light on it, from a different direction to the main beam. This introduces an entirely new feature, for it erases the shadow cast by an obstruction in the main beam. Although it may seem a very small detail, this elimination of shadow is strikingly noticeable when the subject is seen as a whole and definitely draws attention. The illuminating engineer can make good use of this effect when applied with moderation. If carried to excess, however, it is apt to give the building a " whitewashed " appearance.

Thus two methods have been described in which the illuminating engineer can assist and emphasise the design of the architect, firstly by defining a feature by the use of a deep black shadow either above or at the side of it, and, secondly, by directing light from a different angle to the main beam so that a shadow, which would normally be there, is eliminated.

What amount of light should be directed upon a building? How many and what type of units should be used?

For simplicity let us consider a plain vertical wall that has to be evenly lit over the whole of its surface. The familiar equation defining the illumination in such a case is $Ea^2 = I \cos^3 \theta$, where E is the illumination, a the distance of the source from the wall, and θ the angle at which light is received. Now in this instance E and a are constants, since a uniform illumination over the whole of the wall is desired, and the lamps cannot be moved about.

Therefore $I \cos^3 \theta = K$, or, $I = \frac{K}{\cos^3 \theta}$, i.e., I, the candle-power of the source in a given direction, is proportional to the reciprocal of $\cos^3 \theta$.

When $\theta = 0$; $\cos^3 \theta = 1$, and consequently $I = K = Ea^2$, i.e., we have the ordinary inverse square law expressed. Transferring the graph of $I = \frac{K}{\cos^3 \theta}$ to polar co-ordinates, the curve has the general appearance of Fig. 1, which then, should be the polar curve of the ideal floodlamp.

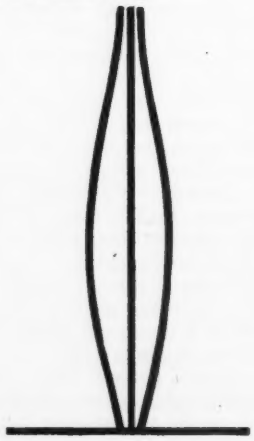

Fig. 1.

This is the type of curve obtained from a spotlight, and the ideal floodlamp for evenly illuminating a vertical wall should be a vertically positioned

unit of this character. This, however, is a theoretical condition. In practice the curve is divided into two and sometimes three sections. The first section is the horizontal type lamp, designed to give that part of the curve from 0° to, say, 35°.

The second section is the vertical type lantern, whose light distribution curve conforms with that part of the final curve between 35° and 65°. In this lantern a reflector system must be incorporated which reflects much light into the region between 55° and 65°.

Beyond this angle the candle-power required is high, and spotlights must be used to achieve the desired result.

In this way the final curve can be made up, or the particular portion required.

When the ideal polar curve has been achieved, only the distance of the lamps from the wall affects the illumination on the surface, which will be distributed according to Fig. 2.

The shape of the curve will always be the same whatever the value of I, and consequently if one point has been fixed, it is possible to know the illumination on the surface when the lamps are placed at *any* distance from it.

If we now consider the horizontal distribution of the light we again obtain the formula $I \cos^3 \theta = R$, which

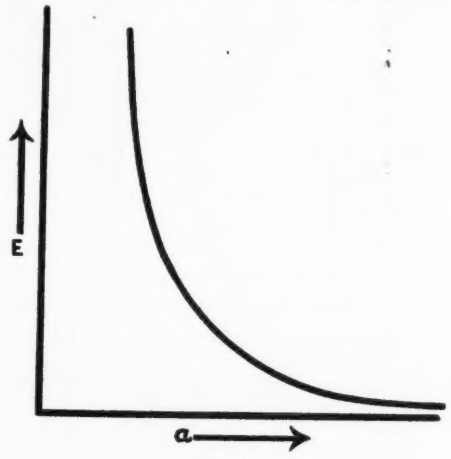

Fig. 2.

is similar to the previous equation obtained for the vertical distribution.

The shape of the horizontal light distribution curve, expressed in polar co-ordinates is shown in Fig. 3. It is difficult to imagine the external appearance of a lamp whose horizonal polar curve will take this contour. Fortunately, however, we are rarely limited to one lamp, and are able to place sources at frequent intervals along the length of the wall. Consequently the curve need not trail away to infinity along the abscissa, but can meet it at some finite point—the distance from the origin being controlled by the space the manufacturer considers suitable between units.

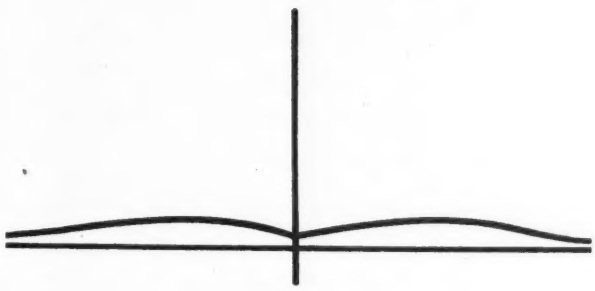

Fig. 3.

The type of units most suitable for floodlighting having thus been considered, the next question that automatically arises is: " What are the most suitable values of E, the illumination? "

There is no rigid rule applying here and the illuminating engineer is thrown entirely upon his own judgment. Different surfaces have their own reflection factor, which is further complicated by the dirt deposited from the atmosphere, and the length of time the surface has been exposed to it.

The deposition of dirt has for some years been the subject of examination, and is receiving much attention from civil engineers—mainly because of its corrosive effects upon buildings. Would it not be possible to examine the same samples for their reflection factor, and co-relate the deposition of dirt with the variation of reflection factor and time?

The amount of light surrounding the observer also influences the intensity needed on the building. Whilst there is apparently no definite law bearing on this subject, and the factors determining the required illumination appear to be only vaguely known, it does seem that useful information might be obtained by research and embodied in tabular data.

National Illumination Committee of Great Britain

(Affiliated to the International Commission on Illumination)

ANNUAL REPORT FOR THE YEAR 1937

Work of the National Committee.

THE Committee has to report a number of changes in its membership as the result of an arrangement between the Committee and the Illumination Industry Committee of the British Standards Institution whereby the personnel of the two Committees has been made identical. When the Illumination Industry Committee was first formed the two Committees had the same membership, but in course of time this ceased to be the case, so that now this very desirable arrangement has been revived. The Committee has thus been strengthened by the addition of the representatives of five new organisations; these are: the Admiralty (represented by Mr. F. P. Fletcher), the Department of Scientific and Industrial Research (by Dr. J. W. T. Walsh), the Glass Manufacturers' Federation (by Messrs. E. J. C. Bowmaker and G. Marchand), the Institution of Municipal and County Engineers (by Mr. E. J. Elford), and the War Office (by the Chief Inspector, Engineer and Signal Stores, Woolwich).

Other changes in membership which have taken place are that Mr. C. B. Collins and Mr. A. Watson have replaced Capt. T. Kerr-Jones and Major R. H. S. Mealing as representing the Air Ministry, while Mr. E. J. Jarvis now represents the Incorporated Municipal Electrical Association instead of Mr. E. E. Hoadley, and the Society

of British Gas Industries has a third representative in Mr. R. J. Rogers.

The conference called by the Committee to consider the education and status of the illuminating engineer was held in January, as mentioned in last year's report. It was attended by about thirty individuals representing in all sixteen academic, administrative, and industrial bodies and, as a result, the City and Guilds of London Institute has appointed an Advisory Committee to consider the question of whether examinations should be offered through the Institute in the subject of Illuminating Engineering, and to prepare the curricula and examination syllabuses. The National Committee was invited to appoint a representative to the Advisory committee, and nominated Professor J. T. MacGregor-Morris to act in this capacity. A syllabus has now been prepared, and examinations will be commenced in two or three years' time.

A meeting of the representatives of all National Committees was held in Paris in June to consider the arrangements for the next meeting of the International Commission on Illumination. Four representatives of the National Committee (Mr. Buckley, Dr. English, Dr. Walsh, and Mr. Watson) were present at this meeting, and it was decided that the next plenary session should be held in Holland in August, 1939, instead of in 1938 as provisionally arranged at the Berlin meeting. This arrangement has the advantage that the International Commission will now not be meeting in the same year as the International Electrotechnical Commission, and it also gives more time for the preparation of reports. It was decided to introduce the subjects of Cinema Lighting and Theatre Stage Lighting into the programme of the Commission and to reintroduce those of Colorimetry, Daylight Illumination, and the Classification of Light Distributions, which had been allowed to lapse for a few years. It was also agreed that the subject of Glare should be widened so as to include all aspects of vision of importance to illuminating engineers, and to include the subject of Traffic Signs in that of Traffic Signals. A provisional programme, in which each subject to be discussed has definite meetings allocated to it, was also arranged.

A meeting of the Vocabulary Committee was held at the same time, and it approved modifications to the draft Vocabulary of Illumination and Photometry. This is now in the hands of the printers and should be available shortly.

The following is a list of the various subjects at present being studied by the International Commission on Illumination, together with the country responsible for organising the work in a secretariat capacity:

Number.	*Subject.*	*Secretariat.*
1a	Vocabulary	Switzerland
1b	Definitions and Symbols	France
2 & 3	Units and Standards of Light	Central Bureau
4	Glare	Great Britain
5	Photometry (Visual)	Hungary
6	Photometry (Physical)	Poland
7	Colorimetry	Germany
21	Light Sources	Germany
22a	Diffusing Materials	Czecho-Slovakia
22b	Classification of Light Distributions	Great Britain
23a	Lighting of Public Ways	Great Britain
23b	Automobile Headlights	Belgium
25	Architectural Lighting	Spain
26a	Aviation (Ground) Lighting	Holland
26b	Aviation (Aircraft) Lighting	France
26c	Traffic Signals	Sweden
27	Daylight Illumination	Austria
29	Mine Lighting	Germany
41	Ultra-violet Light	Holland
62a	Lighting Education	U.S.A.
62b	Applied Lighting	U.S.A.
62c	Voltage Fluctuations	Italy
62d	Cinema Screen Lighting	U.S.A.
62e	Theatre Stage Lighting	Great Britain

The meeting of the Advisory Committee on Photometry of the International Bureau of Weights and Measures, held in Paris in June, agreed to adopt proposals, which will take effect in 1940, for a new unit of candle-power and an agreed method of photometry. The new unit, called the "new" candle, is such that the brightness of a black body at the freezing point of platinum is 60 "new" candles per sq. cm. The proposal concerning an agreed method of photometry is that colour filters, whose integral transmission ratios have been computed from spectrophotometric data and the internationally-agreed visibility curve, shall be used in the derivation of standards differing in colour temperature from that of the new primary standard. The joint effect of these two proposals will be to lower the numerical values assigned to existing tungsten gas-filled standard lamps by about 2 per cent., while leaving those of tungsten vacuum standard lamps practically unchanged.

Work of the Sub-Committees.

The principal activities of the sub-committees have been as follows:—

Physical Photometry.

The sub-committee has been instrumental in circulating a number of glass colour filters to various scientific establishments to ascertain the amount of agreement to be expected in the determination of the spectral transmission of colour filters, especially for those used in work on discharge lamps.

Visual Photometry.

Recent work in Germany has thrown doubt on the standard luminosity data adopted by the International Commission at the Geneva meeting in 1924 and by the International Bureau of Weights and Measures in 1930. Subsequent Work in Great Britain, however, has confirmed the existing data, in so far as the relative luminosities of radiation of wavelengths 5780 A.U. and 5461 A.U. are concerned. This experimental work is proceeding.

Lighting of Public Ways.

This sub-committee has been considering the Street Lighting specification, with special reference to the recently published final report of the Departmental Committee on Street Lighting. Most of the replies to the questionnaire circulated to other National Committees have now been received and are being considered.

Mine Lighting.

A draft reply to the questionnaire from the German National Committee has been prepared, and will shortly be placed before the sub-committee for approval.

Applied Lighting.

Factory Lighting.—An invitation has been received from the Departmental Committee on Factory Lighting, recently appointed by the Home Office, to submit evidence on certain points. The sub-committee is considering the evidence to be presented.

School and Theatre Stage Lighting.—The Illuminating Engineering Society has agreed to act on behalf of the National Committee for the section of Applied Lighting dealing with School Lighting, and also for the new subject of Theatre Stage Lighting.

General.

Once more the Committee acknowledges that it is under considerable obligation to the Illuminating Engineering Society, the Institution of Gas Engineers, and the Institution of Electrical Engineers for their continued interest and financial support, without which the participation of the National Committee in the work of the International Commission would be impossible. The Committee also wishes to express its thanks to the National Physical Laboratory and the British Standards Institution for their unfailing co-operation in all branches of the work.

K. EDGCUMBE, Chairman.

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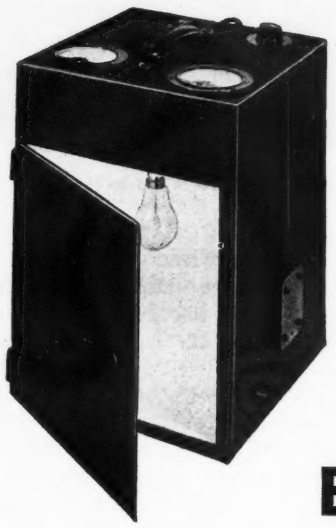

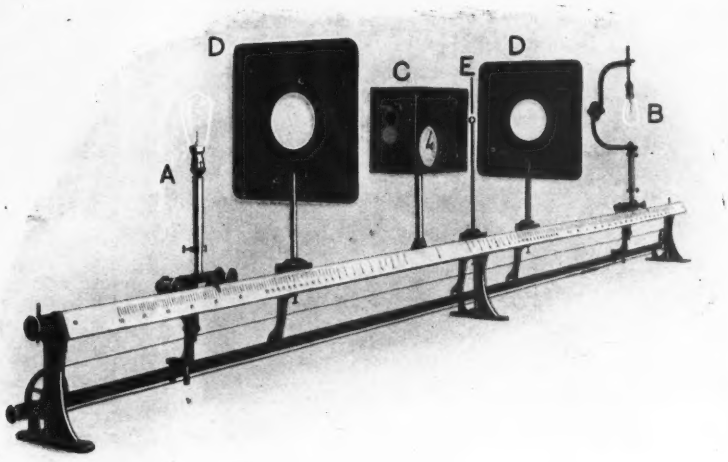

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Promenade Lighting at Morecambe

We illustrate above a column of distinctive design which has been adopted for the lighting of a section of the Promenade at Morecambe, where seventy-five G.E.C. lanterns, equipped with 500-watt Osram lamps, have been recently installed.

Lichfield's Great "Black-out"

On March 8 a particularly complete "black-out" was staged in the City of Lichfield. Visitors from all parts of the British Isles had been invited to witness the demonstration, which took place between 10.30 p.m. and midnight. After visitors had assembled in the Guildhall, where they were welcomed by the Mayor, the first preliminary step was taken—the reduction of normal street lighting to all-night conditions (adopted as an approach to war-time lighting). A brief description of the control system was given by Mr. W. F. Russell, the city engineer. This control equipment, which is designed and manufactured by Standard Telephone and Cables, Ltd., is based on the method of superimposing a bias of 6 volts (supplied by an ordinary car-type battery) to the normal alternating current network. Push buttons transmitted signals switching emergency lighting on and off, calling volunteer firemen and wardens from their homes, sounding sirens at six points in the city for alarm and all clear signals. The system is highly flexible and, whilst primarily intended for street lighting, can readily be applied for other uses.

In addition to the Mayor there were present on the platform the Town Clerk (Mr. A. N. Ballard), Councillor A. L. Garratt (chairman of the Air Raid Committee), Mr. W. F. Russell (city engineer), and Mr. E. A. H. Bowsher (Standard Telephone and Cables, Ltd.). The first warning of attack (from planes assumed to be 100 miles away) was given at 11 p.m. Thereafter all precautionary steps were taken in the correct order leading to a complete black-out at 11.19. (There was subsequently a second alarm and a second extinction of all lights for 30 seconds.) According to all accounts, confirmed by a photograph taken from an adjacent hill and reproduced in *The Mercury* (the local paper), the black-out was most complete and successful.

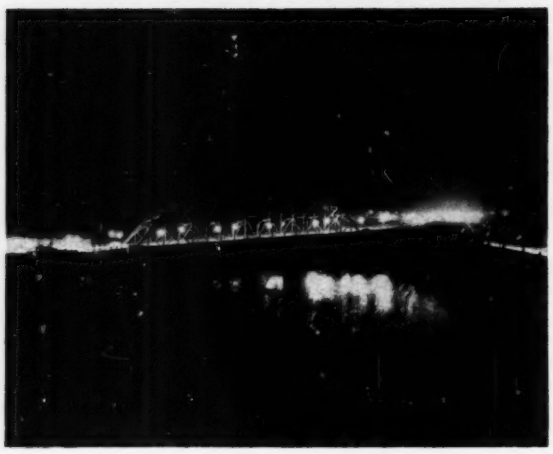


Fig. 1. A general view of the Bridge, seen from a distance.

Fig. 2. Showing the high illumination provided on the approaches.

The World's Most Brilliant Bridge

Crossing the Delaware River, between Easton, Pennsylvania, and Phillipsburg, New Jersey, U.S.A.

We are indebted to Mr. H. E. Dickson, general chairman of the Dedication Committee, for the following account of this recently opened bridge, stated to be the most brilliantly lighted in the world:

This new bridge crosses the Delaware river between Easton, Pennsylvania, and Phillipsburg, New Jersey, and is under the jurisdiction of the Delaware River Joint Toll Bridge Commission, whose offices are in Trenton, New Jersey. This new bridge is to be a toll bridge.

The Easton approach, the bridge, Phillipsburg approach, and plaza have a total curb-line distance of 5,725 ft., along which are located eighty-five 25,000 lumen lamps, having a lamp centre of 21 ft. 10 in. The above, of course, shows an average lamp spacing of 67.35 ft. The locations are staggered. The road surface upon which this illumination will be used is approximately 145,000 sq. ft., which averages 15 lumens per sq. ft. of road surface. The bridge is built of steel, and is of the camel-back design.

About the Phillipsburg plaza and Easton approach to the bridge there are located seventeen twin 25,000 ornamental lighting units and four twin 25,000 ornamental lighting units respectively. The largest street lighting units manufactured to-day are being used, the fixtures being approximately 4 ft. in length. In this plaza are also the toll booths, of which there are six, two being located on each of the three islands. There is an unusually well-lighted warning post located at each end of each island. Extending over the six booths and over four of the traffic lanes is a canopy, entire structure being of steel and glass. Many recessed units of a high wattage are used.

The administration building is a short distance from the toll booths, and is equipped with high intensity indirect lighting throughout, there being many thousand watt lamps installed. Included in many locations in the administration building are unusual applications of lighting too numerous to describe in this short space.

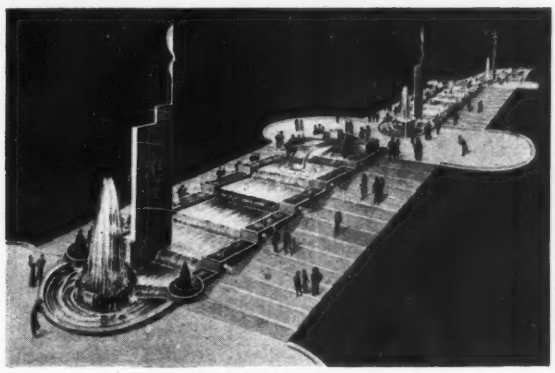
In addition to the previously mentioned lighting for the two approaches, bridge, and plaza, there is an underpass which is lighted in a most modern manner. There are here assembled eight single 15,000 lumen ornamental lighting units, four twin 15,000 lumen units, and thirteen single 10,000 lumen units of similar type, which complete the complement of street lighting equipment for this important bridge.

Fig. 3. Vehicles are seen clearly silhouetted against the brightly illuminated roadway.

Fig. 4. Another view illustrating the visibility of traffic.

The Lighting of the Empire Exhibition (Glasgow)

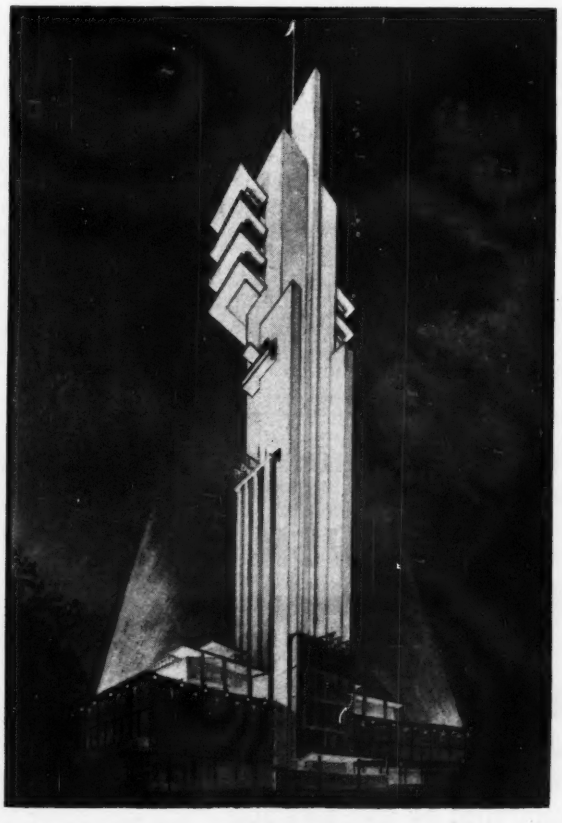
The Exhibition is to be opened on May 3, to cost £10,000,000 and to cover more than 375 acres. There will be decorative lighting throughout the grounds, but the main features will be the water-lighted and the illuminated 300 ft. tower, to be visible 100 miles away.



Illuminated fountains and cascades will form one of the most spectacular lighting features at the Empire Exhibition at Bellahouston Park, Glasgow.

The Empire Exhibition in Bellahouston Park, Glasgow, which is to be opened by H.M. The King on May 3, will be the biggest exhibition ever held in Great Britain. It will cover more than 175 acres, and it is estimated that twenty million people will visit it during the period between May and October. Adjoining the grounds is the Ibrox Stadium, capable of holding 120,000 people. The architect for the Exhibition is Mr. Thomas S. Tait, who designed Sydney Harbour Bridge. About £10,000,000 will be expended.

It is fourteen years since the British Empire Exhibition took place at Wembley. In the interval there have been great developments in lighting technique. One notable step has been the introduction of electric discharge lamps. Much interest, therefore, will be taken in the lighting of the coming Exhibition in Glasgow. In the grounds there will be 1,500 floodlights, 400 ground standards, and thousands of other lamps, varying from 15 to 1,000 watts each. There will be 3,200 ft. of fairy lights festooned from tree to tree, and 400 ornamental lamp standards in the roads and avenues. Some 240 miles of wiring will be necessary.



This metal tower will also be an outstanding landmark at the Exhibition. Floodlighting with Osira lamps will render it visible from a distance of 100 miles.

We gather that straightforward " general " lighting will be found in the roads and avenues, and there will be illuminated banners, floodlighting of foliage of trees, etc. Within the grounds there will be four decorative pylons about 50 ft. high and treated in two-colour neon tubing. The floodlighting of the various buildings will be of great interest, particularly the Palace of Engineering, which is to cover about the same area as Buckingham Palace and to be treated with 143 floodlights involving a total load of 63 kW.

A feature will be the special water-lighting. The Exhibition will be crossed by two giant staircases descending from a hill, with cascades flowing between them. The water is to flow over three sections of five steps, each 15 ft. wide with a drop of 2½ ft., forming miniature waterfalls which will be illuminated from behind by colour sprayed lamps in four colours. At the top of each flight of steps is to be a horizontal fan-jet illuminated by white floodlights. There will be constant colour change. The total load for the cascades will be about 117 kW. Submarine lighting will also be applied to a large fountain, casting water in four different patterns, illuminated by 284 floodlights in changing colours.

Perhaps the most interesting projected item is the 300 ft. tower, standing on the crest of the hill in the centre of the grounds, with three observation galleries nearly 500 ft. above sea level. The balconies are to be equipped with electric discharge lamps, red 400-watt Osira lamps, 250-watt green floodlighting lamps, and 100-watt sodium lamps being used respectively on the three balconies. It is believed that on a clear night the illuminated tower will be visible at a distance of 100 miles.

We are indebted for the above particulars to the General Electric Company, Ltd., who, it is stated, will be very extensively interested in the lighting of the Exhibition.

Floodlighting a Clock with Gas

The floodlighting of clocks by spotlights was a not unfamiliar device before the floodlighting of the faces of buildings was known—many readers will recall a clock in Whitehall that was so treated long before the term had even originated. For this purpose a somewhat narrow beam is, however, necessary. For this reason the case here illustrated, the floodlighting with gas of a clock outside the offices of the Ramsgate Corporation Gas Department, is of some interest.

A view of one of the gaslight projectors with clock controller fixed inside the window.

The picture on the right shows that the clock stands out well from its surroundings. The two projectors used are of the "spotlight" type, each containing one ordinary No. 2 gas-mantle. Telescopic lenses are used to produce an effective beam candle-power of the order of 2,000 for each lamp. Automatic control of the lamps is provided by clock controllers fixed inside the windows.

A general view of the illuminated clock outside the offices of the Ramsgate Corporation Gas Dept.

New Lighting in Hampstead Rd.

Following on the installation of Siemens 400-watt Sieray Lamps in Regent-Sieray Lanterns in the Euston Road, the Metropolitan Borough of St. Pancras has installed similar units for the lighting of Hampstead Road (London).

The photograph gives a good impression of the good visibility secured on both the carriageway and the footpath.

A Conference on Street Lighting

A Conference on Street Lighting for Supply Interests, in conjunction with the Electrical Development Association, is to be held at the E.L.M.A. Lighting Service Bureau, 2, Savoy-hill, London, W.C.2, on May 4.

We understand that, amongst other items, there will be contributions dealing with Tungsten Filament Lamps and Electric Discharge Lamps, the M.O.T. Final Report, and the Benefits to the Electrical Supply Undertaking, and the Town of Good Electric Street Lighting.

Lectures on Illumination Progress

The E.L.M.A. Lighting Service Bureau is also organising a series of four lectures on Illumination Progress, to be held in the Electricity Showrooms of the Hull Corporation Electricity Department. The lectures will take place on consecutive Wednesday evenings, commencing March 16. The subjects are The Partnership of Light and Vision (Mr. H. Lingard), Modern Electric Lamps and their Characteristics (Dr. A. B. Whitworth), Up-to-Date Factory Lighting (Mr. J. W. Howell), and A Review of Modern Lighting Practice (Mr. W. J. Jones).

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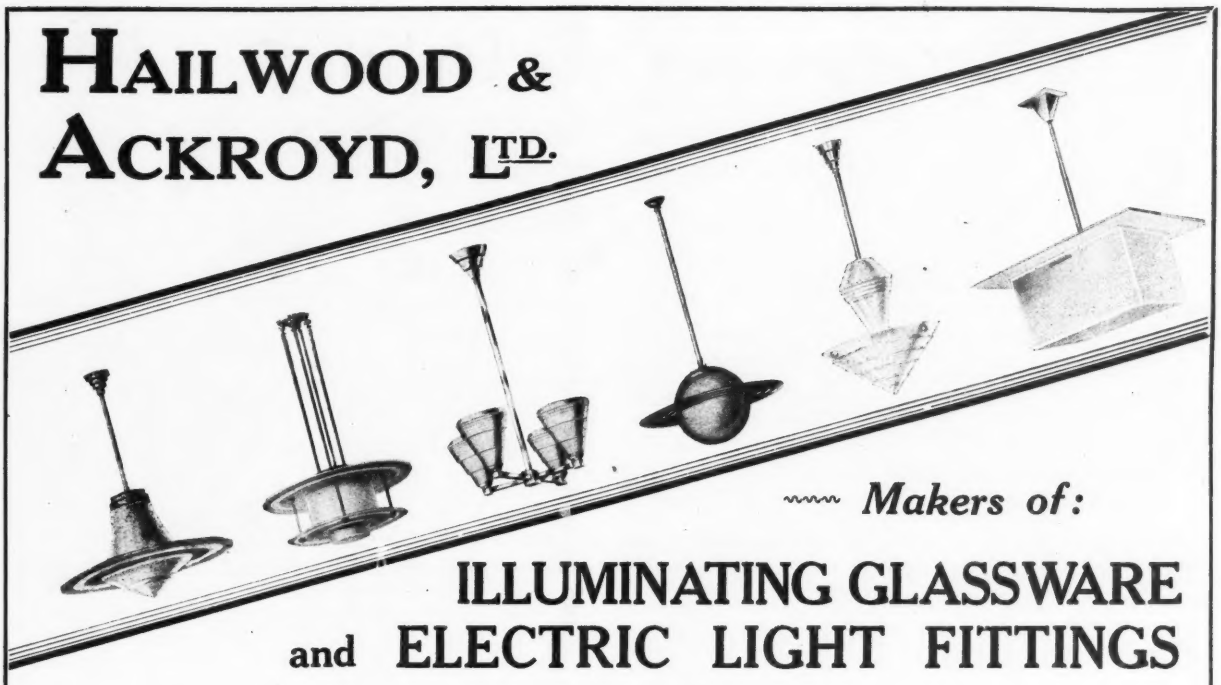

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BIRMINGHAM: 31 Colmore Row. BELFAST: Messrs. Bell & Hull, 17 College Street

Electric Street Lighting

Accrington.—An increase in the candle-power of the existing 219 lamps in certain main roads, costing £159, is proposed. 300 w. lamps will be substituted for those of lower power. Displaced fittings will be used for improvements in side and residential streets.

Bath.—All main road lighting is now carried with sodium electric discharge lamps in accordance with the M.O.T. recommendations.

Birmingham.—During the past year 110 300-w. filament lamps have been displaced by 400 w. mercury electric discharge lamps. In all 3,751 electric lamps have been installed.

Berwick.—An interesting decision in Berwick, to refer the proposed modifications in public lighting to an independent lighting engineer, Mr. J. F. Colquhoun, has led to an opinion, as regards cost, in favour of the proposals for electric lighting. All-night lighting is also advised.

Blackburn.—The Borough Engineer is to collaborate with the Electrical and Gas Engineers in preparing a report on (i) the present cost of street lighting, (ii) the estimated capital cost of improvements to the appropriate standard by electricity and gas, and (iii) the estimated annual cost of maintenance, renewal and repairs.

Bridlington.—The main streets have been recently relighted by 127 400-w. mercury discharge lamps.

Burnley.—Experiments are being made with eleven mercury vapour lamps of the fluorescent type.

Camberwell.—95 per cent. of the modernisation of the lighting is now complete, the most recent development being in the Old Kent Road, where 400 w. mercury discharge lamps, 25 ft. high and 150 ft. apart, have been installed.

East Ham.—Mercury discharge lamps are to be installed in Barking Road at a cost of £1,003.

Finchley.—Comparative tests of sodium and mercury electric discharge lamps are being made.

Jarrow.—Agreement that an installation of sodium discharge lamps, costing £1,332, should be made in York Avenue, has now been reached.

Leeds.—A number of special installations of 300 and 500 w. filament lamps and 400 w. discharge lamps have been arranged for inspection. In some cases units 25 ft. high and 150 ft. apart have been adopted in other cases they have been mounted on existing posts, 18 ft. high, with an overhang of 3 ft. 6 in.

Liverpool.—An interesting new scheme has been put into operation in Hillfoot Avenue, the new by-pass at Hunt's Cross. This is a four carriageway road, with service carriageways on each side and two through traffic ways in the centre. The lighting is by 100 w. sodium lamps in "cut-off" type fittings, mounted 28 ft. high and spaced 90 ft. apart in staggered formation.

Nuneaton.—The Electrical Engineer, having heard criticism of the new sodium lighting, invites opinions from local motorists, cyclists, and pedestrians, who are asked to observe kerb-visibility, study the degree of evenness of lighting on the road surface, and note how far distant small objects crossing the road can be seen. Observers are urged to consider these points irrespective of the colour of the lighting and to avoid looking at the sources of light.

Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

(Continued from page 71, March, 1938.)

II.—PHOTOMETRY.

80. A Phototube Spectrophotometer.

Anon. Electronics, 11, No. 2, p. 54, February, 1938.

A description is given of the circuit employed in a photoelectric transmission spectrophotometer, for the measurement of photosensitive solution. It is claimed that the apparatus will measure a transmission down to 1 per cent. with a precision of about 1 per cent. S. S. B.

81. Measurement of Long Focal-lengths.

H. Schulz. Zeits f. Techn. Physik, No. 2, pp. 34-36, February, 1938.

Describes a method of measurement of long focal-lengths of lenses, in which repeated transmissions are produced by mirrors, and which is said to lead to more accurate results. W. R. S.

III.—SOURCES OF LIGHT.

82. Precision in Manufacture Improves Lamp Quality.

E. W. Beggs. El. Journal, Vol. XXXV., No. 2, p. 51, February, 1938.

An illustrated description is given of the processes involved in the manufacture of tungsten filament lamps, and of the inspection and life tests on the final product. R. G. H.

83. New 500 w. Bi-Post Lamp.

Anon. Am. Illum. Eng. Soc. Trans., 2, p. 115, February, 1938; see also Magazine of Light, VII., p. 2, February, 1938.

A new 500 w. tubular lamp of bi-post construction is described. The over-all length of the lamp is 7½ in., and its diameter is 2½ in. The bulb is inside-frosted, and the average light output is tentatively given as 9,100 lumens. J. S. S.

84. Mercury Lamps Win Favour for Outdoor Lighting.

E. B. Karns. El. Journal, Vol. XXXV., No. 2, p. 65, February, 1938.

A description is given of the mercury vapour lamp, its running characteristics and its auxiliaries. Its use is advocated for petrol-station lighting and similar highway businesses. The distinctive colour is a factor in its ability to attract custom. R. G. H.

85. Fundamentals of Electric Discharge Lamps.

C. G. Found. Am. Illum. Eng. Soc. Trans., 2, pp. 161-192, February, 1938.

This paper discusses at length the processes involved in the production of light by low-pressure gaseous discharge lamps. Some attention is also given to high-pressure lamps and to fluorescent lamps. J. S. S.

86. Brightness of the Mercury Arc.

J. W. Marden, N. C. Beese, G. Meister. Am. Illum. Eng. Soc. Trans., 2, pp. 147-160, February, 1938.

Tests of a large number of mercury vapour lamps, in which the power dissipated per c.c. of arc volume varied from 0.35 to 150,000, show that a logarithmic holds between the brightness and the dissipation per unit volume. This is given as

$$\log_{10} \text{candles/cm}^2 = 1{\cdot}03 \log_{10} \text{watts/cm}^3 + 0{\cdot}40.$$

Data are also given for the variation of brightness across the arc stream. J. S. S.

87. New Type Sodium Light.

Anon. Elect., 120, p. 294, March 4, 1938.

A brief description, with photograph, is given of a sodium street-lighting fitting burning a 10,000 lumen sodium lamp vertically. C. A. M.

88. Technical Development of a Light Source having an "Equal-energy" Visible Spectrum.

M. v. Ardenne. Zeits f. Techn. Physik, No. 2, pp. 41-43, February, 1938.

The light source described depends upon luminescent effects. Photographs and curves are given. W. R. S.

89. Artificial White Light.

M. Luckeish, A. H. Taylor, G. P. Kerr. G.E. Rev., 2, pp. 89-93, February, 1938.

Discusses the essentials of artificial daylight for colour-matching purposes, and describes a range of light sources for producing satisfactory results. The spectral distribution obtained with various daylight lamps and filters is compared with that given by a colour mixture unit employing high-pressure mercury vapour lamps and tungsten filament lamps. J. S. S.

IV.—LIGHTING EQUIPMENT.

90. Electric Signs and Luminous Discharge Installations (Revised British Standard Specification No. 559, 1938, issued February, 1938).

This is a revision of the original specification, issued in 1934. Following the usual list of definitions comes the specification, which falls into three parts dealing with construction, electrical apparatus, and wiring. In Part 1 such matters as material for signs, backing, sheet and glass panels, means of attachment, ventilation, and moisture drainage are discussed. Part 2 specifies details of such apparatus as transformers, and condensers, casing, lampholders, moulded insulating materials, etc. Part 3 covers a wide field, dealing in succession with cable construction, special tests, conductors and supports, and wiring for filament lamp signs and box signs. In an appendix suppression devices for flasher signs are summarised. J. S. D.

91. Novel Electric Animated Cartoon Sign.

Anon. El. Times, 93, p. 226, February 17, 1938.

An animated sign has recently been installed in Trafalgar-square, in which a ciné-projector throws an image on to a large bank of photo-electric cells, which are connected to neon sign lamps. A photograph and diagram are given. W. R. S.

92. Wireless Neon Signs.

Anon. Elect., 120, p. 205, February 18, 1938.

A brief description, with photograph, is given of small discharge tube signs, made to glow by adjacent high-frequency circuits. C. A. M.

93. "Adaptaliers."

Anon. Magazine of Light, VII., pp. 43-44, February, 1938.

A description, with photographs, is given of a new range of plastic bowl reflector units for domestic use. C. A. M.

94. Street Lighting Control.

Anon. El. Times, 93, pp. 191-192, February 10, 1938.

A street-lighting scheme at Hornsey has centralised switching, in which a low-voltage direct current bias, applied to the network, operates polarised relays in the lamp columns. Photographs and circuit diagrams are given. W. R. S.

95. Industrial Manufacture of Krypton and Xenon.

Engineering, CXLIV., p. 464, October 22, 1937; Frank. Inst., J., 225, p. 196, February, 1938.

Some details are given of an industrial process for extracting krypton and xenon from the air, in sufficient quantity to make their use in the incandescent lamp industry a practical possibility. S. S. B.

V.—APPLICATIONS OF LIGHT.

96. Progress during 1937.

H. W. Richardson. G.E.C. Journal, 9, pp. 5-6 and pp. 21-31, February, 1938.

A comprehensive survey is made of progress during 1937 in almost every field of illuminating engineering. C. A. M.

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Absolute resistance to extreme heat and impinging flames—effective diffusion of glare with little stoppage of light—exceptional protection for mantles—rare natural beauty and decorative charm. Such are the qualities essential to all-round efficiency in gas lighting. Only in Vitreosil Lighting Ware is this combination to be found.
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97. The Appraisement of Lighting.

C. C. Paterson. G.E.C. Journal, 9, pp. 55-70. February, 1938.

A complete report is given of the Guthrie Lecture delivered by the author to the Physical Society. C. A. M.

98. Light and Architecture.

Anon. Am. Illum. Eng. Soc. Trans., 2, pp. 119-124, February, 1938.

Some representative architectural lighting schemes are described, with photographs and brief technical data. J. S. S.

99. Relighting the Walters Art Gallery, Baltimore.

C. B. Conway. Am. Illum. Eng. Soc. Trans., 2. pp. 125-146, February, 1938.

This paper deals with the relighting of a museum and art gallery, in which no extensive structural alterations were possible, owing to the need for economy. A satisfying result is claimed with small expenditure. J. S. S.

100. Electricity in Elementary Schools.

F. Evans. Elect., 120, p. 169, February 11, 1938.

The use of electricity for lighting in elementary schools is discussed. Minimum illumination values for various requirements are given. C. A. M.

101. Classroom Lighting.

U. E. Diener. Magazine of Light, VII., pp. 34-37, February, 1938.

Two instances are given of the use of silvered bowl lamps for the lighting of classrooms. C. A. M.

102. Maintenance Pays Dividends in Light.

Anon. El. World, 109, p. 448, January 29, 1938.

The losses of a lighting installation due to neglect of adequate maintenance have been analysed, and the effect of the different factors tabulated. S. S. B.

103. Theatrical Light for Store Interiors.

Anon. El. World, 109, p. 264, January 15, 1938.

Some details and photographs are given of a lens-type spotlight unit, adapted for store display lighting. S. S. B.

104. Natural Fur Shades.

E. C. Hugh. Magazine of Light, VII., pp. 24-25, February, 1938.

Successful results in a fur store have been obtained by the use of combination fittings each containing a 275-watt mercury vapour tube and four 200-watt incandescent lamps. C. A. M.

105. Modern Street Lighting.

Anon. El. Times, 93, p. 197, February 10, 1938.

A review of the Ministry of Transport Final Report mentions mounting height and spacing, overhang, siting, bends and road junctions, power of lanterns, light distribution, and effect of road surface. W. R. S.

106. New Floodlighting for Chicago Utility.

Anon. El. World, 109, p. 586, February 12, 1938.

A description is given of a floodlighting installation, of special interest in the way in which the latest developments in architectural floodlighting have been adapted to the character of an existing building. A special cast aluminium canopy was designed for the mounting of the units. S. S. B.

107. Fluorescent Displays.

G. R. Lawall. Magazine of Light, VII., pp. 13-15, February, 1938.

The potentialities of the use of ultraviolet sources and resulting fluorescent effect for general advertising purposes are discussed. C. A. M.

108. Television in Colour.

Anon. Elect., 120, p. 197, February 18, 1938.

A description is given of a demonstration of television in colour. C. A. M.

Recent Patents

(Abstracts of recent Patents on Illumination & Photometry.)

No. 477,886. "Improvements in or Relating to Automobile Lamps."

Julius Pintsch Aktiengesellschaft. Dated May 28, 1935. (*Convention, Germany.*)

This specification describes an automobile headlamp for producing a beam of light which is widely spread and of low intensity where it strikes the road near the vehicle and is narrower and of higher intensity more remote from the vehicle. The lamp essentially comprises a projecting lens for which the effective light source comprises a multi-part condensing system illuminated by a single point source. The condensing system comprises a number of lens parts of short focal length, each adapted to receive a different part from the light source. These lens parts increase in focal length and diameter from one to the next and have their centres spaced from one another. The projecting lens images on the road surface nearest to the vehicle the condensing lens part of greatest focal length and area, and therefore of least brilliancy, and the projecting lens images on the road surface at a point more remote from the vehicle the condensing lens parts of lesser focal length and diameter and therefore of greater brilliancy.

No. 478,133. "Electric Incandescent Light Source, More Particularly for Television Transmitters."

Radioaktiengesellschaft, D. S. Loewe. Dated July 12, 1935. (*Convention, Germany.*)

According to this specification an incandescent lamp for polyphase supply has an incandescent element for every phase and all the elements are arranged side by side in a plane normal to the direction of projection. The elements may be star or delta connected. A hollow reflector may be arranged behind the element to produce a real image of each element between it and the next.

No. 478,208. "Improvements in and Relating to Electric Discharge Devices."

The British Thomson-Houston Company, Ltd., and Davies, L. J. Dated July 13, 1936.

This specification relates to high-pressure mercury vapour discharge lamps having a pair of elongated electrodes at least one of which is thermionic. The electrodes are arranged so that the space between them has the shape of a truncated V and an arc is swept to and fro along the length of the electrodes by a magnetic field. The arc may thus have a large range of movement while remaining substantially rectilinear.

No. 478,372. "Improvements in or Relating to Electric Discharge Lamps."

Sapiro, M. D. Dated November 8, 1935. (*Convention, U.S.A.*)

This specification has for its object a discharge lamp in which all of the gases of a mixture therein are simultaneously ionized to produce light by a discharge and, moreover, in such a manner that band as opposed to line spectra of the various gases are produced whereby a white light is produced. The invention depends primarily on setting the gas ions into a metastable state in which the atoms have certain electron orbits from which an electron cannot return towards the centre unless there be a positive addition of energy from without the ion. In such a metastable state the gas has an ionization potential quite different from normal and thus helium will ionize simultaneously with argon, neon with argon, and argon with mercury vapour. The metastable ions are produced owing to the presence of a large quantity of free electrons, some of which in entering the orbits of the ions produce re-combination spectra. The spectral lines are caused to be spread to bands by slight variations of the energies of the entering electrons.

The tube for carrying out the invention is similar to a positive column tube, but is operated by an electron emitting electrode heated to such an extent as to supply electrons considerably in excess of the amount necessary to maintain a positive column discharge and sufficient to cause the discharge current to decrease with increase of electron emission.

No. 479,011. "Improvements in or Relating to High-Pressure Metal Vapour Discharge Tubes."

N. V. Philips Gloeilampenfabrieken. Dated August 31, 1936. (*Convention, Germany.*)

This specification covers a high-pressure metal vapour discharge tube having an incandescent refractory metal electrode and an auxiliary incandescent electrode arranged behind the main electrode, when viewed from the discharge path, and provided with a material with a high electron-emitting capacity. The auxiliary electrode acts, on ignition, as the starting electrode of the discharge which passes to the main electrode when the vapour pressure increases.

A resistance is connected between the main and the auxiliary electrode in series with the latter but not with the former. An apertured screen may be arranged in front of the main electrode in the discharge path.

No. 479,220. "Improvements in or Relating to Reflectors for use with Mercury Vapour Discharge and other Lamps."

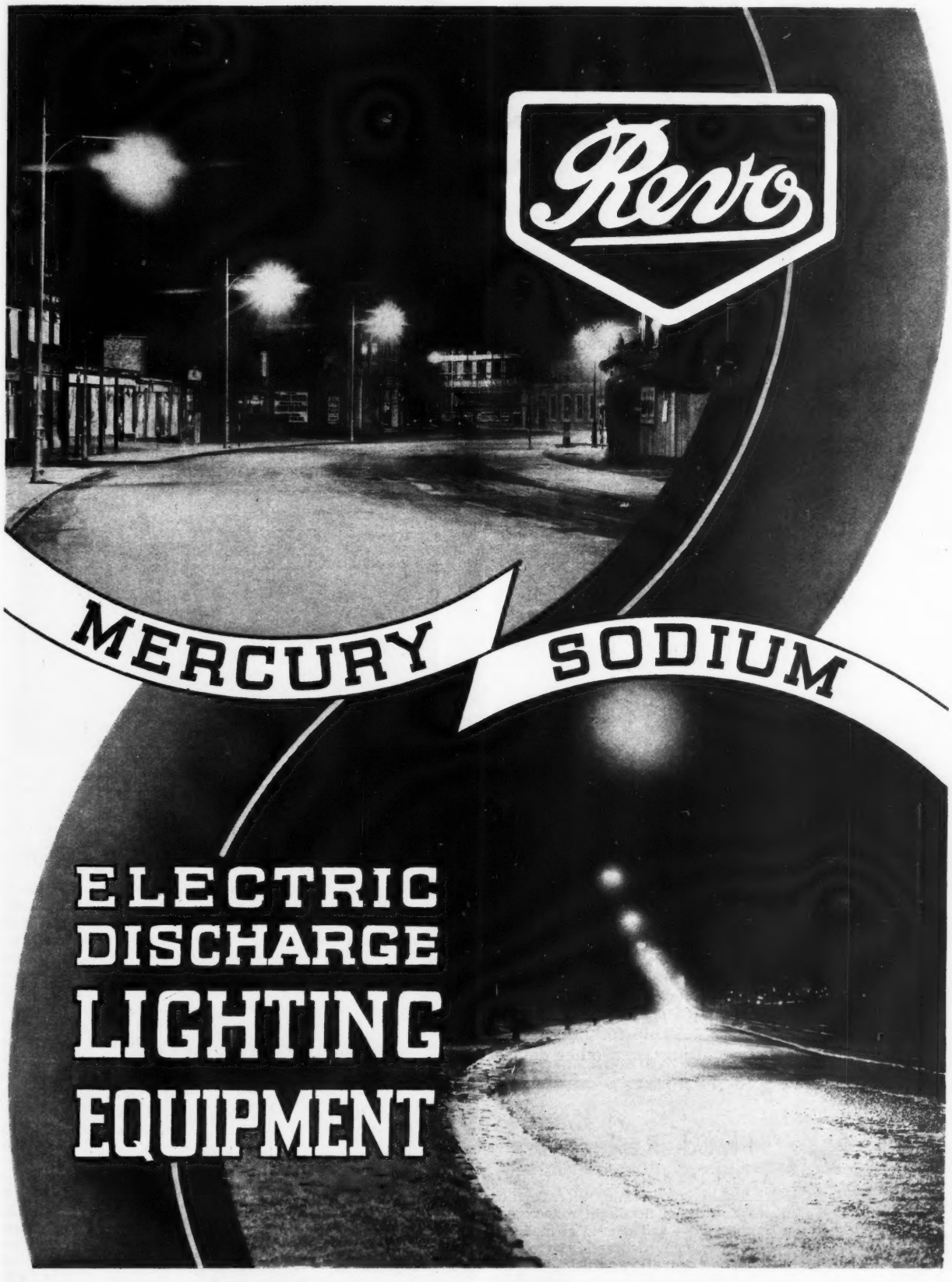
Skinner, G. D., and The Benjamin Electric, Ltd. Dated October 27, 1936.

According to this specification a reflector is constructed of aluminium having an electrolytically produced anodic oxide coating which, while porous, is impregnated with fluorescent material which remains permanently embodied therein after ageing or sealing of the coating.

No. 479,258. "Improvements in and Relating to Light Projecting Devices."

The British Thomson-Houston Company, Ltd., (communicated by The General Electric Company of Schenectady, U.S.A.). Dated May 14, 1937.

According to this specification a projector comprises a concave reflector with an incandescent filament wholly within its concavity and fixed in relation to the reflecting surface substantially at the focus thereof by means of supports having a sealed connection with the reflector body and a cover glass hermetically sealed to the rim of the reflector. The reflector and cover glass thus form the envelope of the incandescent lamp.



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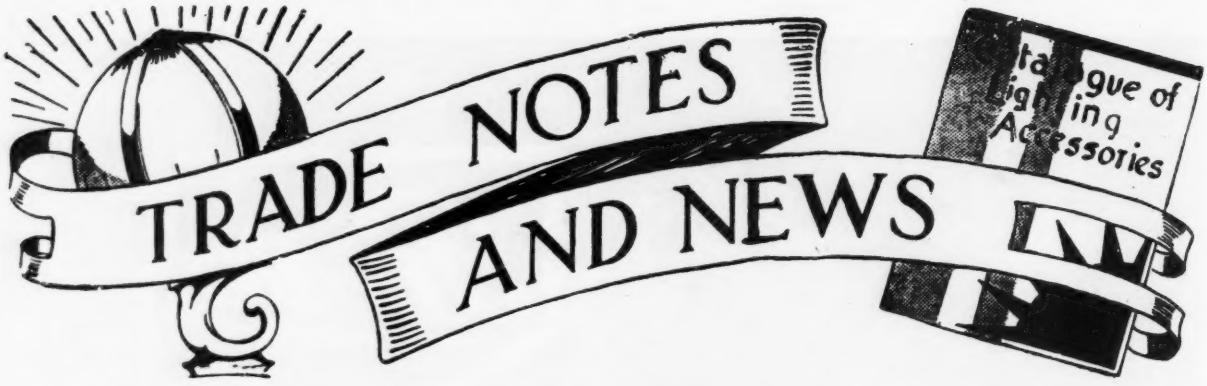
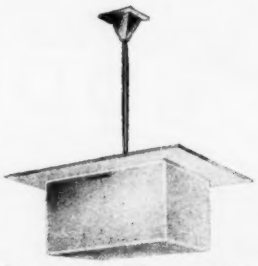


Hailware Products

An excellent variety of glassware is shown in the new catalogue issue by Hailwood and Ackroyd, Ltd. We illustrate below two typical units. In general glassware can be supplied in the familiar three-ply opal and in various colours (champagne opal, rose pink opal, blue opal, or green opal), apart from special tinted colours to suit decorative schemes, whilst metal work may be either copper, bronze, nickel plated or chromium plated. Such opal glass is well adapted to the varied pendant units and bowls illustrated in the catalogue, and to the characteristic

A stepped globe pendant fitting with glass disc.



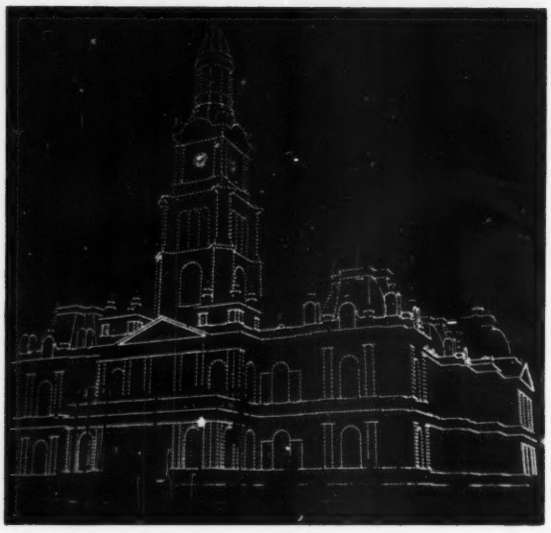
A rectangular globe pendant fitting, also with glass disc.

"Gleamlite" fittings, many of which are of very pleasing and compact design. The firm makes something of a speciality of the cubical and rectangular type of unit, and we notice what we believe is a relatively new line—the special fittings for schools, public buildings, and hospitals, amongst which is listed a form of two-light unit, permitting either direct or indirect light to be obtained at will. Another useful feature is the development of standard types and shapes of decorative glass suitable for building up cornices, wall and ceiling fittings, and other devices used in "architectural" lighting.

Flood Reflectors

A useful list issued by Graham, Farish, Ltd., of Bromley (Kent), illustrates a series of floodlight reflectors of a compact type and offered at moderate prices, of which thousands were sold during the Coronation period. The firm also supplies a handy form of floodlight for which, amongst others, the following advantages are claimed: Adjustability to any angle, simplicity of wiring, adjustable area of illumination, easily removed front on which coloured glass screens can be readily fitted, flexible connections, completely rainproof, and substantial earth connection. A good feature is the solid base, which can be extra-weighted and allows lamp to stand in position without special fixing.

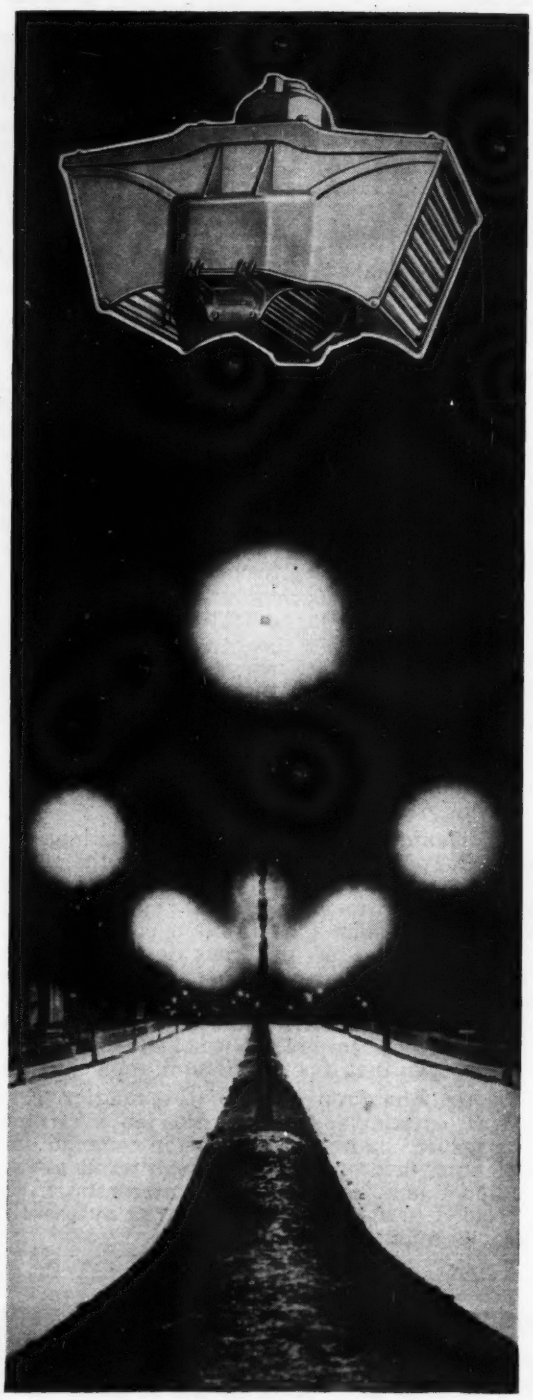
Sydney's Town Hall Illuminated



A view of the Sydney Town Hall illuminated, during the New South Wales 150th Anniversary Celebrations, by thousands of Crompton lamps.

Lighting Control in Islington

We have previously drawn attention to the problem of providing "dusk to dawn" public lighting, as recommended in the M.O.T. Committee's report, and have mentioned some instances in which control is based on the intensity of daylight prevailing at the place considered. Another example is afforded by St. Paul's Road, Islington, shown in the illustration, where several lamps will be seen fitted with light-actuated control. "A" indicates the light-sensitive cell and "B" the unit box. The Borough Electrical Engineer of Islington, Mr. A. P. MacAlister, M.I.E.E., with the co-operation of his distribution engineer, Mr. W. E. Bradshaw, A.M.I.E.E. installed the first light-actuated street lighting units in Islington in the Blackstock Road in August 1932, and have extended the system on their main road lighting during the last twelve months. The control units in the illustration were supplied by Messrs. Radiovisor Parent, Ltd., and installed by the Islington Electricity Department.



St. Helier Avenue, Morden, lighted by Mercra 'H' Lanterns. The installation, recently completed by the County of London Electric Supply Co. Ltd., conforms entirely with M.O.T. Regulations and represents the peak of street lighting technique

Horizontal Lighting with mercury discharge lamps *was originated by BTH in 1934.* **The new Mercra 'H' Lantern is still the only lantern in which a standard high-efficiency mercury lamp can be used without a special choke.**

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A patented magnetic deflector is incorporated in the Mercra 'H' Lantern, and this enables a standard 400 watt Mercra Lamp to be burned in a horizontal position, thus giving all the advantages of improved light distribution and control without sacrifice of efficiency.

BTH Lighting Engineers will be pleased to advise, without obligation, on any contemplated Street Lighting scheme.

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"LUX"
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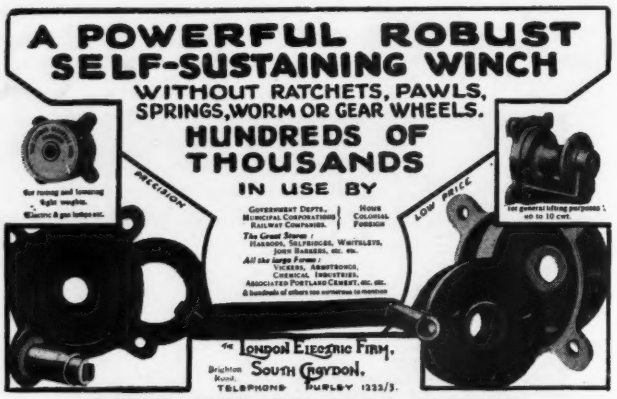
WE have pleasure in announcing to our readers that we have entered into an arrangement to receive subscriptions for the French Journal "Lux" (La Revue de l'Eclairage). The subscription per annum is 30 francs, the approximate equivalent of which in English money is Seven Shillings and Sixpence (7/6).

"Lux" is the only French journal which specialises in all aspects of lighting; it is the official organ of the Association Française des Ingenieurs de l'Eclairage (equivalent to the Illuminating Engineering Society in France).

It furnishes a complete record of interesting developments in lighting in France and on the Continent. It is fully illustrated and in particular devotes a considerable number of its pages to Decorative Lighting.

By studying these articles and the numerous photographic reproductions of modern lighting installations the reader can readily gain an excellent impression of French methods and practice in matters of Illumination.

Applications for subscriptions will be received by "Light and Lighting," 32, Victoria Street, London, S.W.1.



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The Illuminating Engineering Society (U.S.A.)

Notes on the Current Transactions (February, 1938)

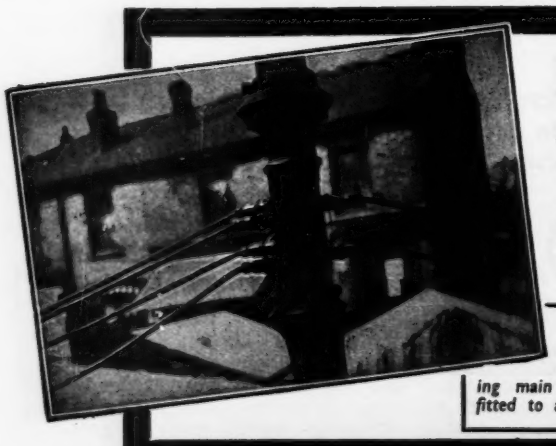
NEWS: Last year the Chicago Lighting Institute started a series of *ten minute talks over four radio stations.* These were very well received, and the Institute was asked to continue them. The introduction of a *new* 500-*watt bi-post lamp,* designed for use in projector apparatus, has been announced. It incorporates means of binding volatile tungsten particles and thus reducing their darkening effect. It may be mounted either "base up" or "base down." *A building* has been erected in Manhattan *consisting completely of glass,* with no openings, except doors and three display windows. The 4,000 glass bricks used for the exterior walls are similar in texture to "Pyrex" glass, and a perfect distribution of daylight and thermal insulation is reported. The Westinghouse Electric Manufacturing Company has installed what is described as *the largest combination mercury-incandescent lighting installation in the country.* In a small motor plant 600 combination luminaires are spaced 18 ft. centre-centre, each fitting comprising a 400-watt mercury and three 200-watt tungsten lamps, equal to 16,000 lumens per point: average illumination is reported as 33 foot-candles.

SUBJECTS OF PAPERS: *Relighting the Walters Art Gallery, Baltimore, Maryland.* Author, Clinton B. Conway. Mr. Conway gives a survey of the problems and their solution in this scheme, and draws comparisons with other recent similar work. He recommends the exclusion of natural daylight in rooms where the exhibits are changed frequently. But in rooms where objects are exhibited for long periods and where it is expected the same visitors will come several times to view the same objects natural daylight is preferred. Colour correction means increased wattage, but this is unavoidable.

Brightness of the Mercury Arc. By J. W. Marden, N. C. Beese, and G. Meister. Experiments are reported, the results of which establish certain rules between lumens output and wattage. Laboratory types of arc lamps have been brought up to the brightness of the sun, and with an efficiency of not more than 65 lumens per watt. Water-cooled types attain 70 lumens per watt.

Fundamentals of Electric Discharge Lamps. By Clifton G. Found. The paper deals with the physical processes required to produce light in gaseous discharge tubes. It touches upon all types of discharge lamps and explains the effect, in combination, on their performance of numerous detailed processes. It is pointed out that in connection with tungsten lamps all constructive data bearing upon every possible effect is available. Knowledge of the internal processes in a discharge lamp is not equally complete, but it is hoped that this will be so in the near future.

Comments on Proper Use of Illumination Terms. By G. H. Stickney and E. C. Crittenden. Warning is given against the misuse of terms in common use in the lighting field—for instance, such terms as "illumination" and "intensity." Misinterpretation may be avoided if the definition approved by the I.E.S. is kept in mind.



A "NIPHAN" market lighting installation showing main feeding sockets fitted to a lamp standard.

MARKET LIGHTING

FOR some years we have been collaborating with supply authorities in devising temporary lighting installations for market stalls. The picture shows part of a "NIPHAN" market job, in which 6 sockets, in conjunction with a fuse board, were mounted on a lamp standard, with plugs leading to 3-way tees, and suspended through-sockets. ¶ *Our extensive market lighting experience is at your disposal.*

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36

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38

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Index to "Where to Buy"

Accessories	32	Industrial Lighting	4, 12, 13, 21, 23, 30, 41
Artificial Daylight	30	Lampshades	39
Architectural Lighting	1, 9, 18, 19, 25, 35, 40	Local Lighting	10, 26
Automatic Light Control	17, 22, 29, 34	Photo Electric Cells	29
Cinema Lighting	19, 21, 28, 31, 36	Photometers	2, 14
Concrete Pillars, etc.	7	Reflectors	3, 4, 9, 11, 12, 21, 35, 38, 41
Electric Lamps	5, 31	Signal Lights	41
Film Studio Equipment	23	Special Lighting	3, 18, 21, 23, 28, 30, 36, 40
Fittings 1, 3, 4, 8, 12, 13, 16, 18, 19, 20, 21, 23, 25, 26, 27, 28, 30, 31, 35, 36, 37, 38, 39, 40, 41		Steel Standards	6
Floodlighting	3, 5, 16, 21, 31, 36, 37, 41	Street Lighting Units	5, 11, 12, 13, 21, 23, 24, 27, 31, 37, 41
Gaslighting	24, 27, 37	Testing Laboratories	15
Glassware	21	Theatre Lighting	3, 21, 36
		Time Switches	17, 22
		Winches and Suspension Gear	33

N.B.—The numbers are those attached to individual entries in the Directory (See pp. 105-107).

37

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CAPITAL

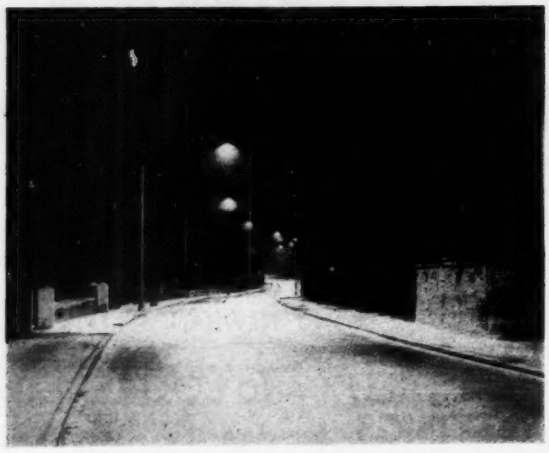
Bank Official (retired) has clients wanting active and non-active Directorships in new or established companies with investments of £2,000 to £5,000. Proofs available of £1,750,000 invested. Write Box 287, Sells, Ltd., 14, Lancaster Place, London, W.C.2.

E.L.M.A. Illumination Design Courses

The Illumination Design Course for supply undertakings, opened at the E.L.M.A. Lighting Service Bureau on March 7, drew an excellent attendance. Good points in connection with textile lighting were made by Mr. J. W. Howell who cited facts to justify the 30 foot-candles recommended for worstead weaving. The vexed question of church lighting was dealt with by Mr. E. B. Sawyer who pointed out that improved lighting could be used to reveal architectural beauties hitherto shrouded in gloom. A luncheon at the Holborn Restaurant, over which Mr. H. A. Lingard presided, served to conclude the course.

The March course is to be followed, during May 9-11, by an Illumination Design Course for contractors, wholesalers, and manufacturers. A programme of fifteen addresses, which cover a wide range, has been arranged so that those who take part should get plenty of condensed information. Such topics as planning lighting installations, light measurement, ship lighting, architectural lighting and floodlighting will be discussed. There is even a contribution, for which Mr. E. B. Sawyer is responsible, on "Opportunities in Public House Lighting" (!) On the final day visitors will be the guests of the E.L.M.A. at an informal luncheon. No doubt the course will prove fully as attractive as its predecessor, and those interested are advised to apply to the E.L.M.A. Lighting Service Bureau (2, Savoy-hill, London, W.C.2) in good time.

Sodium Lighting in Croydon



The illustration above shows a further extension of public lighting with sodium electric discharge lamps in the Croydon area. The roadways treated comprise South Norwood Hill, White Horse-lane, and Beulah Hill. The installation consists of 100 watt "Philora" sodium lamps furnished by Philips Lamps, Ltd., in Wardle "Liverpool" lanterns (designed by Mr. P. J. Robinson). The units are centrally suspended at intervals of 30 yds. and at a height of 25 ft. The schemes have been carried out under the supervision of Mr. Rendall Baker, the lighting engineer to the Croydon Borough Council.

Public Lighting with Gas

At the annual general meeting of the Tottenham and District Gas Company it was announced that all gas street lamps would shortly be fitted with an automatic lighting device obviating the necessity of a by-pass. There are 10,706 public lamps in this area—an increase of 288 during the year.

The South Suburban Gas Company likewise reports an increase (341) in the number of public lamps, and an increase of consumption of gas of 11 per cent. over 1936.

In Newcastle-upon-Tyne, where the increase in the number of lamps is 773 (making a total of 28,000), the increase in gas consumption, as compared with 1936, was 9 per cent.

Comparative tests of the merits of gas and electric lighting are to be conducted in Minehead before the new contract for public lighting is arranged.

The Middlesbrough Corporation is installing gas lamps mounted 25 ft. high on bracket arm posts on over one and three-quarter miles of trunk road. The lighting on this important thoroughfare will comply with Group A classification of the M.O.T. Report.

Denton's new lighting, which has aroused much interest, is carried out by 133 12-light gas lamps spaced 38-40 yards apart and 22 ft. high. There is a straight run of two and a half miles so lighted. In all 1,072 lamps are covered by the ten-year contract for gas lighting.

Other recent renewals of contracts include Pontypridd (about 780 lamps), Port Talbot (1,170 lamps), Rothesay (228 lamps), Writtesley and Westbury (160 lamps).

Following the recent installation of modern gas lamps in the Newark Road, the Lincoln City Council has decided to instal a further 59 lamps of the same type on other main roads. On other sections of roadway twenty-six high pressure gas lamps are to be installed.

MINISTRY OF TRANSPORT

Roads Department

Applications are invited for appointment as Assistant Engineer in the Roads Department of the Ministry of Transport. Assistant Engineers are liable for service at the Headquarters or at any of the local offices of the Ministry.

Commencing salary for men £340, rising, subject to approved service, by annual increments of £18 to £466, thence by annual increments of £25 to a maximum of £600; for women, £337, rising, subject to approved service, by annual increments of £12 to £397, thence by annual increments of £18 to £456 (this scale is at present under review). The appointments will be on an established pensionable basis, and will be subject to a probationary period of one year. Assistant Engineers are eligible for promotion to higher posts.

Candidates must be Corporate Members of the Institute of Civil Engineers or hold some equivalent qualification, and be experienced in the design and installation of street-lighting systems, preparation of specifications, and investigations of the performance of equipment. In addition, a knowledge of testing methods in relation to electrical work is desired.

Candidates must not have attained the age of thirty-five on the 1st February, 1938, but candidates who have served, or are serving, in the Navy, Army, or Air Force may deduct from their age for this purpose any time not exceeding five years during which they have so served.

Forms of application can be obtained from the Assistant Secretary, Establishment Department, Ministry of Transport, Metropole Buildings, Northumberland-avenue, W.C.2. No application can be considered unless received by the Ministry of Transport on the recognised form on or before 4th April. Canvassing through Members of Parliament or in other ways will render a candidate liable to disqualification.

Catalogues and Advertising Literature

We invite all firms in the Lighting Industry to send us new catalogues as they appear, for reference in these columns.

BRITISH ELECTRIC DEVELOPMENT ASSOCIATION.—Illustrated booklet entitled "Electric Street Lighting." A feature is the summary of the M.O.T. Report, recommendations of which are illustrated by special sketches. Photographs of typical installations also appear.

GENERAL ELECTRIC COMPANY, LTD.—Catalogue entitled "Osram Photo-Cells and G.E.C. Relays," also progress sheet dealing with lighting fittings, socket outlets and plugs, and other accessories; also the *Osram Bulletin* for March, in which pictures of varied lighting installations appear.

HAILWOOD AND ACKROYD, LTD.—An illustrated catalogue (No. S./17/6) showing a great variety of illuminating glassware and fittings.

PHILIPS LAMPS, LTD.—The Philora Bulletin (No. 2, 1938) contains a description, illustrated by effective pictures in colour, of the decorative lighting at the Paris Exhibition.

SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD.—Illustrated leaflet (No. 545), featuring Siemens "Sphere" fittings.

SIMPLEX ELECTRIC COMPANY, LTD.—Lists of Ironclad switch and fuse gear, Creda electric water heaters.

Lighting a Portable Boxing Ring

The Simplex Electric Company, Ltd., have just completed an order for the Air Ministry for somewhat unusual lighting equipment which is intended for the illumination of a portable boxing ring, and has been designed to withstand the effects of tropical heat, humidity, and driving sand. The fitting consists of nine 500-watt concentrating type "Displex" reflector units arranged in three rows of three each and supported by tubular framework. A canvas curtain 3 ft. 6 in. deep, which is painted white on the inside services to screen the equipment from the view of the audience.